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Notice of Allowability	Application No.	Applicant(s)	
	09/721,249	SRINIVASAN, RAVI	
	Examiner	Art Unit	
	Tiffany A Fetzner	2859	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 07/30/2004.
2. ☒ The allowed claim(s) is/are 2-6,9,11-14 and 16-2630.
3. ☒ The drawings filed on 03/18/2004 Sheets 3-14 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☒ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☒ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☒ hereto or 2) ☐ to Paper No./Mail Date 09/09/2004.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input checked="" type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input checked="" type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date <u>08/09/2004</u> . |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____ |

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with Associate **Attorney Kenneth W. Fafrak Reg. No. 50,689** on August 9th 2004 along with authorization to charge any necessary fees to applicant's deposit account.
3. The application has been amended as follows:

A) Replace claim 2 with the following Examiner amended claim 2:

Claim 2 --- An integrated radio-frequency coil array, comprising:

- a first coil spanning a first field of view (FOV);
- a first driving means for driving the first coil to image;
- a second coil spanning a second FOV;
- a second driving means for driving the second coil to image;
- a third coil spanning a third FOV, wherein a combined FOV of the second and third coil is substantially equivalent to the first FOV;
- a third driving means for driving the third coil to image, wherein at least two of the first, second and third coils can be driven simultaneously to obtain a combined image and each coil can be driven independently to obtain an image; and
- a first common coil path that includes at least one reactive component, wherein the second coil and the third coil share the first common coil path without overlap, and the second coil and the third coil adjoin one another without overlap. ---

B) Replace claim 20 with the following Examiner amended claim 20, because the claim has now been rejoined to the instant application:

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Claim 20 --- The coil array of **claim 2**, wherein

the first coil is a first long birdcage comprising a first ring interconnected to a second ring,

the second coil is a second short birdcage located relative to the first long birdcage, comprising the first ring interconnected to the central ring, and

the third coil is a third short birdcage located relative to the first long birdcage and the second short birdcage, comprising the central ring interconnected to the third ring. --

C) Replace claim 21 with the following **Examiner amended claim 21**, because the claim has now been rejoined to the instant application:

Claim 21 --- The coil array of **claim 20**, wherein a $k=1$ linear mode of the second short birdcage and the third short birdcage is tuned and matched to about 50 ohms at the nuclear magnetic resonance (NMR) frequency, and the $k=1$ linear mode of the first long birdcage is tuned to the NMR frequency. ---

D) Replace claim 22 with the following **Examiner amended claim 22**, because the claim has now been rejoined to the instant application:

Claim 22 --- The coil array of **claim 20**, wherein the second short birdcage and the third short birdcage are isolated from the first long birdcage when the second short birdcage and the third short birdcage are driven with currents of equal amplitudes 180 degrees out of phase. ---

E) Replace claim 23 with the following **Examiner amended claim 23**, because the claim has now been rejoined to the instant application:

Claim 23 --- The coil array of **claim 20**, wherein the second short birdcage and the third short birdcage have substantially the same dimensions. ---

F) Replace claim 24 with the following **Examiner amended claim 24**, because the claim has now been rejoined to the instant application:

Claim 24 --- The coil array of **claim 23**, wherein the second short birdcage and the third short birdcage are about one half the length of the first long birdcage. ---

G) Replace claim 25 with the following **Examiner amended claim 25**, because the claim has now been rejoined to the instant application:

Claim 25 --- The coil array of **claim 20**, wherein the central ring is decoupled with respect to the first long birdcage. ---

H) Replace claim 26 with the following **Examiner amended claim 26**, because the claim has now been rejoined to the instant application:

Claim 26 --- The coil array of **claim 20**, wherein the first long birdcage, the second short birdcage and the third short birdcage are in a high pass configuration. ---

I) Cancel claims 27 through 29.

J) Replace claim 30 with the following **Examiner amended claim 30**, because the claim has now been rejoined to the instant application:

Claim 30 --- The coil array of **claim 20**, wherein the coil array is a volume type coil and a final image produced by the coil array includes a combination of a homogenous mode produced by the first large birdcage and an RF gradient mode produced by the second small birdcage and the third small birdcage. ---

K) Cancel claim 31.

L) Replace claim 32 with the following Examiner amended claim 32, because the claim has now been rejoined to the instant application:

Claim 32 --- The coil array of **claim 20**, wherein the first long birdcage is driven by a coupling method selected from the group consisting of inductive coupling and capacitive coupling. ---

M) Replace claim 33 with the following Examiner amended claim 33, because the claim has now been rejoined to the instant application:

Claim 33 --- The coil array of **claim 32**, wherein the first a rectangular loop and the combined second small birdcage and third small birdcage is driven by a figure eight loop. ---

N) Replace claim 34 with the following Examiner amended claim 34, because the claim has now been rejoined to the instant application:

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Claim 34 --- The coil array of **claim 32**, wherein a homogenous mode produced by the first long birdcage and a radio frequency gradient mode produced by the combined second small birdcage and third small birdcage is combined along a coil axis. ---

O) Cancel claims 35 through 38.

P) Replace claim 39 with the following Examiner amended claim 39, because the claim has now been rejoined to the instant application:

Claim 39 --- The coil array of **claim 20** wherein an RF gradient mode is generated along a coil axis of a combined second small birdcage and third small birdcage. ---

Q) Replace claim 40 with the following Examiner amended claim 40, because the claim has now been rejoined to the instant application:

Claim 40 --- The coil array of **claim 39** wherein the RF gradient mode is in quadrature. ---

R) Replace claim 41 with the following Examiner amended claim 41, because the claim has now been rejoined to the instant application:

Claim 41 --- The coil array of **claim 39** wherein the RF gradient mode comprises two linear RF gradient modes orthogonal to one another. ---

S) Replace claim 46 with the following Examiner amended claim 46:

Claim 46 --- The coil array of **claim 2**,

wherein the first driving means includes a first inductive coupling loop coupled to the first coil, the second driving means includes a second inductive coupling loop coupled to the second coil, and the third driving means includes a third inductive coupling loop coupled to the third coil, and

wherein the second inductive coupling loop of the second driving means and the third inductive coupling loop of the third driving means are overlapped to cancel a net mutual flux between the second inductive coupling loop of the second driving means and the third inductive coupling loop of the third driving means. ---

Examiner's Comment

Response to Arguments

4. Applicant's After-final arguments with respect to pending **claims 2-6, 9, 11-14, 16-19 and 42-49** have been considered and in view of applicant's **after-final amendments to independent claim 2**, of July 30th 2004 are considered persuasive. However, because originally filed claims 20-41 were withdrawn during prosecution in order to be allowed they must be reinstated by examiner's amendment. The examiner has marked the after-final submission of 07/30/2004 as "**Do not enter**" because in order to rectify all of the remaining formalities an examiner's amendment is necessary.
5. The examiner has amended claim 2, by examiner's amendment as presented by applicant in the July 30th 2004 after-final amendment. The **examiner has reinstated originally filed claims 20-26, 30, 32-34, and 40-41 by examiner's amendment**. The examiner has also amended **claim 46** to clarify that the inductive loops of the respective driving means constitute the feature that is overlapped in dependent claim 46, so that there is no contradiction between the limitations of **examiner amended claim 2**, and the limitations of **examiner amended dependent claim 46**. The amendments have been authorized by applicant's representative.

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6. The rejections of all the previous office actions are rescinded, in view of the examiner's amendments to the claims above.

Drawings

7. Drawing pages 3-14 submitted March 18th 2004 which comprise FORMAL DRAWING pages 1/12 through 12/12 are accepted by the examiner as formal drawings.

8. Drawing page 2 of the 14 drawing pages submitted March 18th 2004 shows the applicant's proposed drawing changes to figures 1a, 1b, 2a, 2b, 3a, 3b, 4a, and 4b; which are shown in FORMAL DRAWING format on pages 3-6 of the March 18th 2004 submission, identified as FORMAL DRAWING pages "1/12, 2/12, 3/12, and 4/12".

Drawing page 1 of the 14 drawing pages submitted March 18th 2004 shows the applicant's proposed drawing changes to figure 9; which is shown in FORMAL DRAWING format on page 12 of the March 18th 2004 submission, identified as FORMAL DRAWING page "10/12".

The following is an examiner's statement of **Reasons for Allowance**:

9. With respect to **examiner amended claims 2-6, 9, 11-14, 16-26, 30, 32-34, 39-49**. These claims are allowable over the prior art of record because the prior art of record does not disclose or suggest an integrated radio-frequency coil array", comprising: three coils, three fields of view and three driving means "wherein a combined FOV of the second and third coil is substantially equivalent to the first FOV; a third driving means for driving the third coil to image, wherein at least two of the first, second and third coils can be driven simultaneously to obtain a combined image and each coil can be driven independently to obtain an image; and a first common coil path that includes at least one reactive component, **wherein the second coil and the third coil share the first common coil path without overlap, and the second coil and the third coil adjoin one another without overlap,**" in combination with the remaining limitations of each of the claims. It is the combination of the claim limitations taken as a whole that constitutes both the novelty and non-obviousness of applicant's claims.

10. The examiner notes that **examiner amended claim 46** is not contradictory to **examiner amended claim 2**, because **examiner amended claim 2** requires that the second and third coils adjoin one another with a common coil path without overlap. **Examiner amended claim 46** requires that the respective driving means overlap while the second and third coils adjoin one another via the common coil path without overlap. An overlapped driving means is not the same thing as an overlapped coil; therefore there is no contradiction within the limitations of **examiner amended claim 46**.

11. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Prior Art made of Record

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

A) Molyneaux et al., US patent 5,757,189 issued May 26th 1998. [See figures 2, 2a, 2b, 2c]

B) Vij US patent 5,682,098 issued October 28th 1997. Which shows an open quadrature array with three figure-8 shaped surface coils. three

C) Srinivasan et al., US patent 5,602,479 issued February 11th 1997 [See figures 10, 11, 6, 7, 1 and 2]

D) Murphy-Boesch et al., US patent 5,194,811 issued March 16th 1993 [See Figure 2b, 4a, 8a]

E) Srinivasan US patent 6,177,797 B1 issued January 23rd 2001 with an effective date of December 19th 1996.

F) Srinivasan US patent 5,999,000 issued December 7th 1999 with an effective date of November 8th 1996.

G) Wong US patent 6,285,189 B1 issued September 4th 2001 filed September 4th 1999. [See figures 3c 4a, 4b, 4c2b, 2d, 2e, 1]

H) Hayes US patent 4,694,255 issued September 15th 1987. [See figure 10, 2b, 12].

I) Srinivasan US patent 5,777,474 issued July 7th 1998.

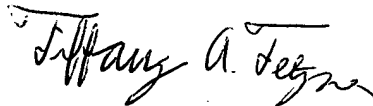
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J) **Srinivasan** PCT international publication WO 98/37438 published August 27th 1998 this reference lacks showing a structure wherein "the second coil and the third coil share the first common coil path without overlap, and the second coil and the third coil adjoin one another without overlap" as required by applicant's examiner amended after final claims.

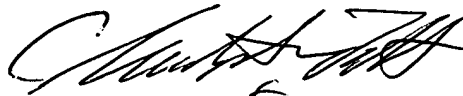
Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

14. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306**.



TAF
August 9, 2004



Diego Gutierrez
Supervisory Patent Examiner
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CHRISTOPHER W. FULTON
PRIMARY EXAMINER